Chapter 2 – 30/8.18

Intelligent Agents

An agent is anything that can be viewed as perceiving its environment. It operates in an environment, with sensors to perceive the world. It has some sort of “brain”.

Rational agents are autonomous: makes its decisions according to the current situation and changes their plans accordingly. The relation between agent and environment are its perceptions and its actions. Actuators are for example the hands, feet, ears etc of a human.

An agent function maps from perception to actions: f: P -> A. The agent program runs on the physical architecture to produce f. Agent= architetchture+program.

Example: Vacuum cleaner world:

P: The **performance measure**

E: The agent’s prior knowledge about the **environment**

A: The actions that the agent can perform, **actuators**

S: The percept sequence, **sensors**

A rational agent should select an action that is expected to maximize its performance measure, give:

The evidence provided by the percept sequence.

Rational does not mean omniscient or clairvoyant. Percepts only some information and outcome action may not be as expected. A rational agent chooses whichever action maximizes the expected value of the performance measure given the percept sequence to date. Selected performance measure evaluates the environment sequence. It should perform actions in line with the design objectives.

For example, an autonomous vacuum-cleaner is considered to be rational even though it can only go left, right and suck. It will get by with these three functions, but with other functions it can become smarter and make better choices considering power consumption, noise, time spent etc. A smarter version would be able to remember where it has been, so it doesn’t clean an already cleaned area again.

There can also be a penalty system where it will lose “points” if it does unnecessary tasks.

Fully observable environments = agent has access to the information it needs. Partially observable environments = agent may not be able to gain all the information it needs, either because its sensors cant detect everything, or because the information is unavailable to obtain for other reason.

**Deterministic environment**

* The next state depends only on current state and agent’s action
* - Any action has a single guaranteed effect. There is no uncertainty about the state that will result from performing an action.
* If the environment is deterministic except for the actions of the other agents, we say that the environment is strategic.

**Stochastic environment**

* There is some uncertainty about the outcome of a action
* -Non-deterministic environments- possible outcomes only, not probabilities, present greater problems for agent design.
* Stochastic is not the same as non-deterministic.

**Episodic environments**

The agent’s experience is divided into atomic episodes. Each episode consists of the agent perceiving and then performing a single action The episodes are independent. The choice of action in each episode depends only on the episode itself

**Sequential environments**

The current decision could affect all future decisions Episodic environments are much simpler than sequential because the agent does not need to think ahead

**Discrete**

Finite number of distinct states and percepts/actions, e.g. chess

**Continuous**

Continuous time/state/actions: taxi driver

**Static environment**

Can be assumed to remain unchanged except by the performance of actions by the agent the agent doesn’t need to keep looking at the world while it is deciding on an action, nor need it worry about the passage of time.

**Dynamic environment**

Can change while an agent is deliberating. Has other processes operating on it, and changes in ways beyond the agent’s control. Demand quick decisions from the agent. Semidynamic when the world does not change but the agent’s performance score does - chess with clock

**Known environment**

The agent’s knowledge about how the environment works/evolves

Note that a known environment (i.e., the agent knows all the rules that apply) may be only partially observable if the sensors are not properly working

**Unknown environment**

The agent will have to learn how it works. A known environment can be partially observable.

**Single agent vs multiagent**

Which entitier will be viewed as other agents? Competitive and cooperative interactions Can randomized behavior be rational in multiagent environments? The environment type largely determines the agent design The real world is (of course) partially observable, stochastic, sequential, dynamic, continuous, multi-agent

Four basic types in order of increasing generality: – simple reflex agents – model-based reflex agent – goal-based agents – utility-based agents All these can be turned into learning agents

**Summary**

- Agents interact with environments through actuators and sensors. The agent function describes what the agent does in all circumstances. The performance measure evaluates the environment sequence. A perfectly rational agent maximizes expected performance Agent programs implement (some) agent functions PEAS descriptions define task environments Environments are categorized along several dimensions: observable? deterministic? episodic? static? discrete? single-agent? Several basic agent architectures exist: reflex, reflex with state, goal-based, utility-based